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(71) Applicant *(for all designated States except US)*: **AAVID THERMALLOY, LLC** [US/US]; 80 Commercial Street, Concord, NH 03301 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **FISHER, Francis, Edward** [GB/GB]; 74 Tamworth Drive, Swindon SN5 5SG (GB). **LOVETT, Terence, Edward** [GB/GB]; 53 Merton Avenue, Swindon SN2 7PZ (GB).

(74) Agent: **WEISZ, Edward, M.**; Cohen, Pontani, Lieberman & Pavane, 551 Fifth Avenue, Suite 1210, New York, NY 10176 (US).

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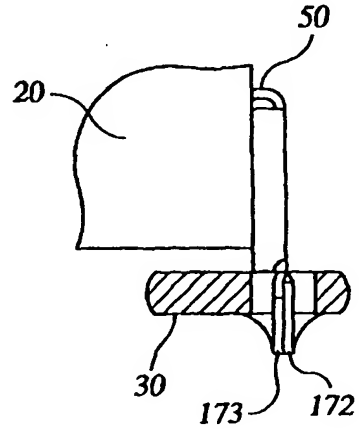
(54) Title: SUPPORT CLIP



(57) Abstract: A clip for mounting a component such as a heat sink to a support such a printed circuit board, in particular to stabilize the position of the component until the clip can be soldered to the support, includes a securing portion having a pair of feet received in the support and a supporting portion having a pair of arms received in the component in an interference fit. According to a preferred embodiment, the feet are separated by a slit and are formed into parallel planes so that the feet can overlap when compressed toward each other during insertion into a hole in a printed circuit board, and have outward facing barbs which engage the printed circuit board.

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Support Clip

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a clip suitable for use in supporting and securing a component such as an electronic device or a heat sink to a mounting surface such as one face of a printed circuit board.

2. Description of the Related Art

A major cost in the manufacture of equipment is attributable to assembly costs. Cost can be minimized in this area if a reliable means for attachment of components is available, and if an automated procedure can be utilized. The nature of the component to be attached in the assembly procedure can limit the available means for attachment. Factors such as shape and weight have to be considered, but in the electronics field consideration has to be given also to proximity to other components, and the subsequent treatment of the assembled parts, which may involve movement during transport of the assembled product on the assembly line. Many components must be accurately and selectively mounted in a particular position and supported such as to be reliably retained in the selected position regardless of motion or shock influences during subsequent processing of the assembled product. A specific example is components attached to a printed circuit board. Typical forms of attachment include solderable tabs for insertion in prepared mounting recesses, and interference fittings which may be combined with a solder contact fastening. Where a limited number of attachment points is

available, the mass of such a package could create difficulties in reliably supporting the package during an intricate soldering step to fix the package in its operational site on the circuit board. A relatively bulky component such as a heat sink may need to be mounted with a gap between the heat sink and some another component or the surface of a printed circuit board. The ability to present the heat sink or package to which the heat sink may be attached in a manner which consistently achieves the required spacing in a reliable automated assembly procedure can be challenging.

One example of a currently convenient way of manufacturing heat sinks is by extrusion. The preparation of an extruded heat sink component for mounting includes attachment of tin-plated brass pins which are adapted to be inserted into prepared recesses in the desired location on the printed circuit board (socket mounting), and attachment is completed by soldering to the printed circuit board, e.g. by wave soldering or reflow soldering.

Heat dissipating components, commonly referred to as heat sinks, are passive devices formed from a metal such as aluminum, copper, or metal alloys with good thermal conductivity, such as copper with tungsten. Examples of heat dissipating components are described in U.S. Patent Nos. 4,509,839 and 5,991,154; the latter also discloses a support base which is fixed to the heat sink. However, the present invention is not limited to the particular components described therein.

Such heat sinks and the electronic devices that they are intended to protect are generally soldered using a solder paste containing a lead-tin alloy.

U.S. 5, 844, 312 (Hinshaw *et al.*) shows a one-piece stamped and formed clip which can be wedged into grooves in a heat sink. An electronic device such as a transistor clips into a raised portion provided on the clip, and infurcated feet are received in holes in a printed circuit board. Other known clips for mounting heat sinks have round pins which are inserted into holes provided in the extruded component.

The assembly of the above type of supports with the various heat sinks and other components is time consuming and expensive. Furthermore, stability is difficult to guarantee while supporting the assembly for soldering.

SUMMARY OF THE INVENTION

It is an object of the present invention to improve the attachment of components to a surface in an assembly line, such as a line for manufacturing products utilizing electronic devices. A further object of the invention is to provide a clip for attaching a component to a printed circuit board, either manually for small production runs, but more especially by use of automatic means for volume production. A still further object of the invention is to provide a means for reliably attaching a heat sink in an operational position upon a printed circuit board. Yet another object of the invention is to provide a method of attaching an article using a soldering method, providing better stability for the

article during the attachment process. It is also an object of the present invention to provide a support clip, which makes assembly of a heat sink together with an electronic device upon a printed circuit board easier.

According to a first aspect of the present invention there is provided a clip for attaching a component to a support by a soldering technique, the clip having a stiff securing portion having at least one peripheral part adapted to provide at least one solderable connection to the support, and a support portion extending away from the securing portion and adapted to cooperate with a component to be mounted to the support.

Preferably, the peripheral part of the clip has a plurality of mounting feet arranged along an edge of the securing portion, which edge in use would confront the surface of a support to which the component is to be attached. Preferably, the feet are adapted for insertion in recesses or apertures in the support. Alternatively, the feet may be arranged to conform to the surface and may be surface mounted by soldering.

Preferably, the mounting tab comprises a resilient member having two sections which can be compressed toward each other during insertion.

Such a clip may be formed from a generally flat substrate having sufficient flexibility and resilient properties to permit forming, structural shape-retention after forming, and pressure or interference fitting on a support. Thus it is convenient to form the clip from a metal sheet, e.g. by

pressing, stamping, cutting, punching or the like metal forming steps. The clip may be formed from a light metal carrier sheet with either area-specific selective coating or overall plating of a solder compatible metal, e.g. tin or an alloy thereof, so as to be compatible with solder paste commonly used in the industry. The clip may be prepared for the intended pressure or interference fit with a component to be attached to a support by mechanical working such as cutting, or punching of suitable parts to provide keying means such as tabs, fingers, tongues, barbs, detents, etc. The component to be mounted using the clip may have a corresponding slot, groove, recess, notch, lug or stop formation adapted to cooperate with the keying means formed on the clip.

According to another aspect of the invention, an assembly includes a component to be mounted on the support in an operational position by a soldering technique, and a plurality of clips attached to the component. At least one of the clips has a securing portion adapted to provide solderable connections to the support, and a supporting portion or distal keying means extending away from the securing portion and adapted to cooperate with the component by an interference fit. Each of the clips is preferably of the same type and has at least two solderable connections, e.g. in the form of feet, for attaching the clip to a support. Where the component to be attached is an extrusion product, it is convenient to provide a clip at the free ends of the extrusion product, whereby a stable attachment via at least four points is achieved.

The assembly is ideally suited to attaching a heat sink to a printed circuit board. More complex packages may also be mounted on a board in the same way. By choosing the length of the securing portion of the clip and/or the attachment position of the supporting portion, the component may be spaced from the support (board) or in contact therewith according to choice.

According to a still further aspect of the invention, a method of attaching a component to a support comprises providing a plurality of clips, each such clip having a stiff securing portion having peripheral parts adapted to provide solderable connections to the intended support, and a supporting portion connected to and extending away from the stiff securing portion and adapted to cooperate with a component to be attached to a support, providing a component with means for cooperating with the securing portion by an interference fit, fitting a sufficient number of clips to the component to form an assembly having a plurality of limbs having solderable connections aligned for presentation to a support, presenting the assembly to a selected position on a support, and soldering the assembly in position on the support.

By using the clips, an extruded body, preferably a heat sink, is provided with stable supports which facilitate positioning and attachment of the extruded body to a support either manually in small production runs or automatically. The assembly of the component and the clips described herein provides for a stable support at four or more points on a circuit

board and attachment simply by inserting the respective parts of the clip into a slot available or provided in the board. The distal keying interference fit of the supporting portion of each clip provides a point of support at each end or corner of the device. A lower insertion force is required for attaching the assembly to a surface such as a printed circuit board, which facilitates reliable positioning for soldering and better quality control of the product.

Optionally, the clip may provide a stand-off position in supporting the component above the circuit board to prevent the device from contact with the circuit board.

In a preferred form, the assembly comprises an extruded heat sink body provided with a keyway for insertion of a clip at a desired support position for the body, e.g. an end face of the body; a clip of substantially "L"-shaped profile having a stiff limb to serve as an upright support in the intended use thereof, said limb having solderable connections at an edge for fixing to the intended support, and distal keying means connected to and extending away from the stiff limb, the keying means being adapted for an interference fit in the keyway in the extruded heat sink body.

In a further preferred form of the clip used in such an assembly, the strength of the stiff limb is improved by providing sidewalls formed out of the plane of the limb, e.g. to provide a "C"-, or "U"-, lazy "S"-, or "Z"-shaped profile when viewing the limb of the clip in section.

In one form, the supporting portion keying means comprises a bifurcated part having arms provided with barbs , whereby due to the resilience of the clip material, the part can be force-fitted into a keyway by compression of the arms towards one another and thereafter resists withdrawal.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described, by way of example only, by reference to the accompanying drawings, in which:

Fig. 1 is a partial side view of an assembly in accordance with the present invention;

Fig. 2 is a partial end view of the extrusion body of Fig. 1;

Fig. 3 is a partial end view of the assembly shown in Fig. 1;

Figs. 4(a) to (c) are elevation, side, and plan views of the clip in Fig. 1;

Fig. 5 is a partial side view of a further embodiment of the present invention;

Fig. 6 is a partial end view of the assembly shown in Fig. 5;

Figs. 7(a) to (c) are elevation, side, and plan views of the alternative clip of Fig. 6;

Fig. 8 is a partial side view of the embodiment shown in Fig. 1 with a stand-off portion;

Fig. 9 is a partial side view of the embodiment of Fig. 6 with a stand-off portion;

Fig. 10(a) is an elevation view of a further embodiment of the clip;

Fig. 10(b) is a partial elevation view of the embodiment of Fig. 10(a) where the clip is mounted to a circuit board;

Fig. 10(c) is a side view of the embodiment of Fig. 10(a);

Figs. 11(a) and 11(b) show an extrusion connected to the clip of Fig. 10(a); and

Figs. 12(a) and 12(b) show a further embodiment of the clip similar to that of Figs. 11(a) and 11(b) but having a stand off section.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

Referring to Figs. 1 and 2 of the drawings, there is shown the general arrangement of the support clip 10 of a first embodiment of the present invention with one end of the component device 20 of Fig. 2 being supported above a circuit board 30. This arrangement shows the securing portion 40 of the clip 10 inserted into the board 30 and the supporting portion 50 inserted into the component 20. A similar clip 10 is provided at the opposite end of the component 20 (not shown) so that the device is supported at each end by a clip 10.

Referring to Fig. 3, the securing portion 40 of the clip includes a main rectangular sheet section 60 which has two feet 70 extending downwardly, one at either side of the main section 60. The 70 are inserted into respective holes in the circuit board 30 and soldered to secure the clip onto the board. This main section 60 has a recess 80 formed between feet 70, which provides clearance for feet 70 to be inserted into the board.

Referring to Figs. 4(a) to (c), the side view of Fig. 4(b) clearly shows the L-shape of the clip 10

with the securing portion 40 being wider than the supporting portion 50. An angular profile 90 formed at the end of each foot provides a lead-in allowing the clip to be inserted into the holes quicker and more accurately. Where the inner surface 100 of the foot or grip 70 meets with the edge of the recess 80, a curved undercut 110 relieves shear stress and allows the clip 10 to sit level on the surface of the circuit board. Adjacent to each undercut 110, there is provided a circular aperture 120 which serves as an integral thermal break for reducing heat transfer in the soldering process.

Referring to Fig. 4(c), the supporting portion 50 is bifurcated to form two arms which are spaced for an interference fit in the slot 130 of the extruded device. Each arm has a distal end 140 with a tapered profile 142, which assists in insertion in the slot 130 as the arms are pressed together, and a barb 144 which engages the slot 130 under the resilient force of the arms 50.

Figs. 5 and 6 of the drawings show a second embodiment of the present invention. The clip 10 is formed at each side of the main section 60 by folding the securing portion 40 to form side walls 160 which are substantially perpendicular with the section 60. These sidewalls 160 have edges 162 which contact the component 20 to stabilize the position of the component with respect to the clip 10. Where the component is a heat sink, this also improves heat dissipation. Figs. 7(a) to (c) show various views of such a clip having feet 70 extending from respective sidewalls 160. This geometry also provides the clip with additional rigidity and

stability, so that the feet 70 cannot readily be bent transversely to the plane of the main section 60 when the clip is mounted to circuit board 30. The position of the component with respect to the circuit board is therefore stabilized.

Figs. 8 and 9 show the embodiments of Figs. 1 and 5 wherein the overall length of the securing portion 40 has been increased by a particular amount so that the component is raised above the surface of the circuit board 30, which can improve heat dissipation from the component.

Figs. 10(a) to (d) and Fig. 11 show further embodiments of the invention. In these embodiments the reference numerals used in Figs. 1 to 9 have been retained where similar or identical features are described.

Fig. 10(a) shows a support clip 11 with a securing portion 41 having a grip 171 which is bifurcated by a slit 191 to form separate feet 172, 173 having outwardly facing barbs 181. The slit ends at a circular aperture 121 located between the grip 171 and the main section 61. The circular aperture 121 relieves shear stress and permits the feet to be deformed out of the plane of the main section 61. It also serves as an integral thermal break which reduces heat transfer in the soldering process. Arcuate undercuts 211 which relieve shear stress are provided between the feet 172, 173 and the main section 161.

Fig. 10(b) shows the grip attached to a circuit board 30. The grip 171 projects through a hole 221 in the circuit board 30 and the barbs 181 engage the circuit board to provide a secure, stable grip. The

force used to insert the grip 171 into the hole 221 compresses the feet 172, 173 toward one another causing the feet to overlap at the slit 191, thereby reducing the overall width of the grip and allowing the grip to be inserted into the hole 221. The overlap of sections 172 and 173 can be seen in Fig. 10(c). The structure of the grip is similar to that of a pen nib. In other embodiments, the slit may be a wider gap and the compressive force may cause the sections to be urged towards one another to narrow the width of the gap, without overlapping.

Having a grip 171 that provides a strong attachment to the circuit board 30 is advantageous during soldering as it minimizes movement of the support clip 11. In addition, the use of a single grip reduces the number of holes required in the circuit board to one at each end of an extrusion profile.

In Figs. 11(a) and 11(b) a side view and a back view of the embodiment of Fig. 10 are shown with an extruded heat sink attached thereto . In this example, the extruded heat sink 20 is in contact with the surface of the circuit board 30 and the edges 162 of the formed sidewalls 160 of the retaining portion 41.

Figs. 12(a) and 12(b) show an embodiment similar to that of Figs. 11(a) and 11(b) wherein the overall length of the securing means has been increased so that the extruded device 20 is raised above the circuit board 30.

The material from which the clip itself is made is a solderable sheet material, typically cooper alloy. This sheet is stamped and formed to the shapes

described above. Advantageously, using a stamped and formed part reduces the cost per unit.

The embodiments described are given as examples only, and are not intended to limit the scope of the invention.

CLAIMS

1. A clip for mounting a component to a support, said clip comprising:

a securing portion comprising a main section and a pair of feet adapted for mounting to said support; and

a supporting portion extending laterally from the securing portion and adapted to be received in the component in an interference fit.

2. A clip as in claim 1 wherein said supporting portion comprises a pair of arms which can be compressed toward each other to achieve said interference fit.

3. A clip as in claim 2 wherein said arms are provided with outward facing barbs which engage said component.

4. A clip as in claim 1 further comprising a pair of side walls which extend laterally from said main section.

5. A lip as in claim 4 wherein said feet extend from said sidewalls.

6. A clip as in claim 1 wherein said main section has an edge from which said feet extend, said edge being provided with arcuate undercuts adjacent to said feet.

7. A clip as in claim 1 wherein said main section has an edge from which said feet extend, said edge being positioned to space said component above the support when the assembly is mounted to a support with said edge abutting the support.

8. A clip as in claim 1 wherein said feet are spaced apart.

9. A clip as in claim 1 wherein said main section has an edge from which said feet extend, said feet being separated by a slit and formed into different planes, whereby said feet can overlap at said slit when compressed toward each other.

10. A clip as in claim 9 wherein said slit terminates at an aperture in said securing section.

11. A clip as in claim 9 wherein said feet are formed with outward facing barbs which can engage a support.

12 A clip as in claim 1 wherein said clip is stamped and formed from a single piece of sheet metal.

13. An assembly for mounting to as support, said assembly comprising:

a component having a keyway; and

a clip having a securing portion and a supporting portion, said securing portion comprising a main section and a pair of feet adapted for mounting to said support, said supporting portion extending

laterally from the securing portion and being received in the keyway in an interference fit.

14. An assembly as in claim 13 wherein said supporting portion comprises a pair of arms which are compressed toward each other to achieve said interference fit.

15. An assembly as in claim 14 wherein said arms are provided with outward facing barbs which engage said component.

16. An assembly as in claim 13 further comprising a pair of side walls which extend laterally from said main section and abut against said component.

17. An assembly as in claim 16 wherein said feet extend from said sidewalls.

18. An assembly as in claim 13 wherein said main section has an edge from which said feet extend, said edge being provided with arcuate undercuts adjacent to said feet.

19. An assembly as in claim 13 wherein said main section has an edge from which said feet extend, said edge being positioned to space said component above the support when the assembly is mounted to a support with said edge abutting the support.

20. An assembly as in claim 13 wherein said feet are spaced apart.

21. An assembly as in claim 13 wherein said main section has an edge from which said feet extend, said feet being separated by a slit and formed into different planes, whereby said feet can overlap at said slit when compressed toward each other.

22. An assembly as in claim 21 wherein said slit terminates at an aperture in said securing section.

23. An assembly as in claim 21 wherein said feet are formed with outward facing barbs which can engage a support.

24 An assembly as in claim 13 wherein said clip is stamped and formed from a single piece of sheet metal.

25. An assembly as in claim 13 wherein said component is an extruded heat sink.

26. An assembly as in claim 13 comprising two of said clips fixed to said component.

FIG.1

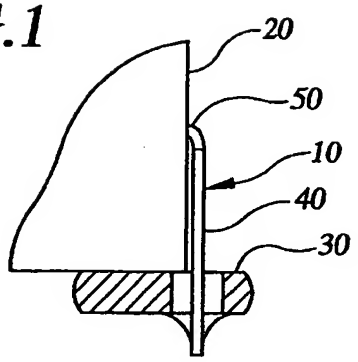

FIG.2

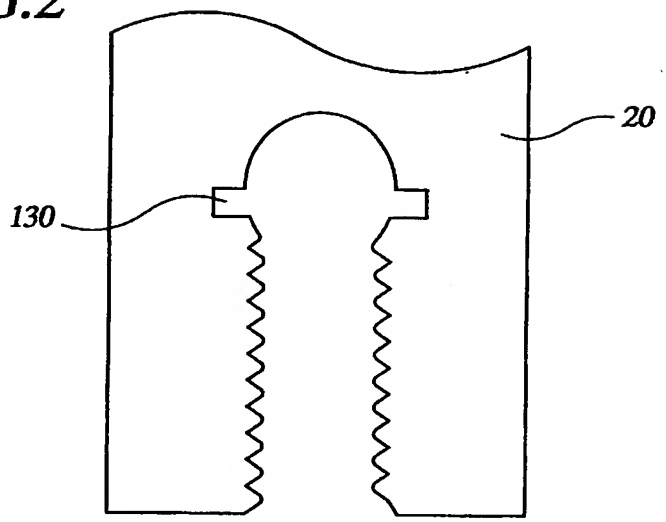

FIG.3

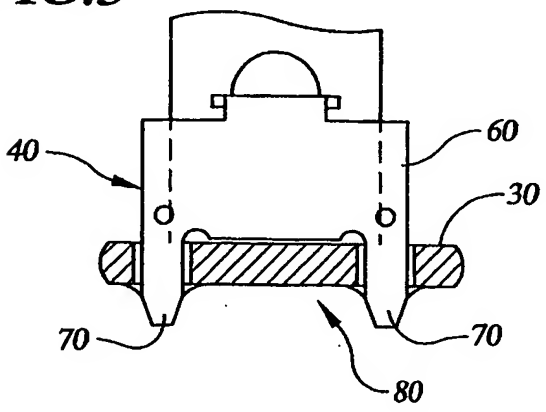

FIG.4(a)

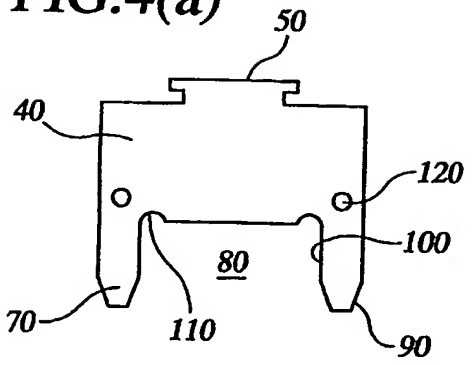

FIG.5

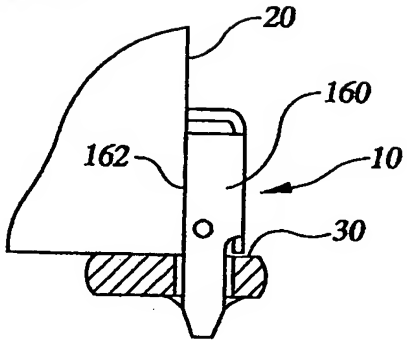

FIG.4(b)

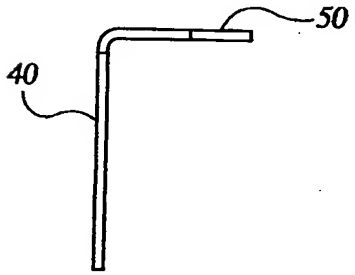

FIG.6

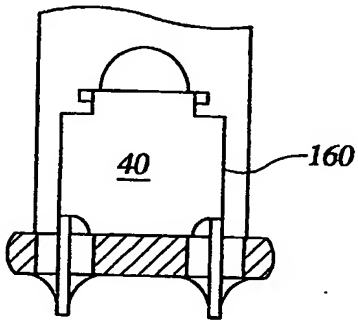

FIG.4(c)

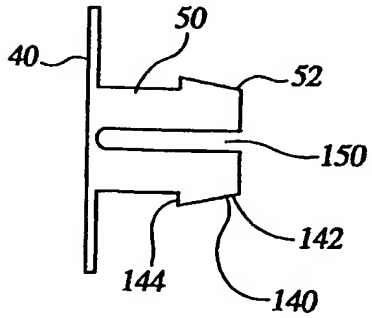

FIG.7(a)

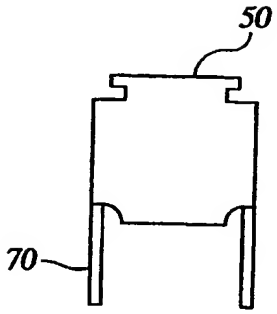

FIG.8

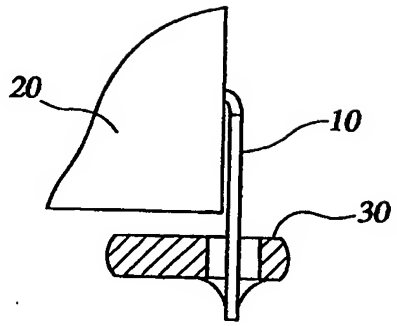

FIG.7(b)

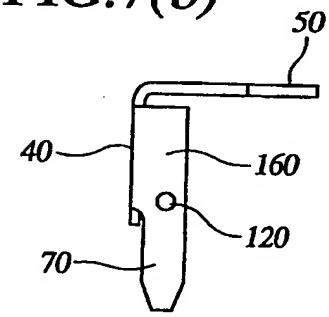

FIG.9

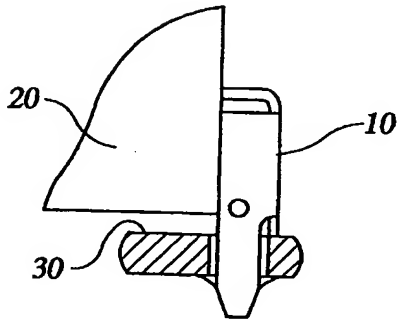

FIG.7(c)

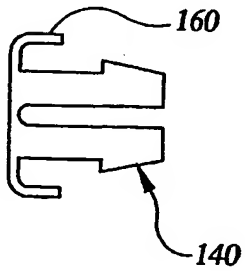

FIG.10(a)

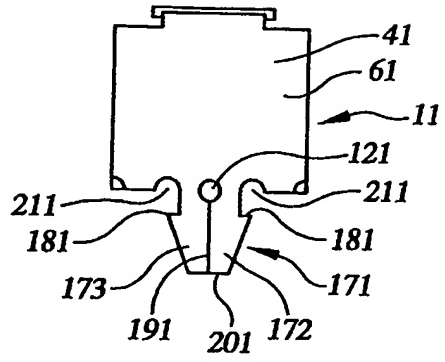

FIG.10(b)

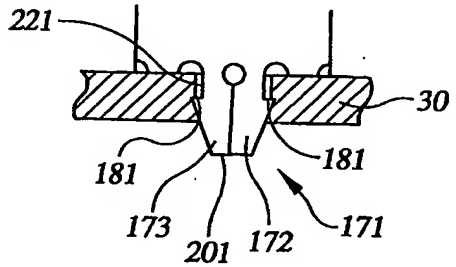

FIG.10(c)

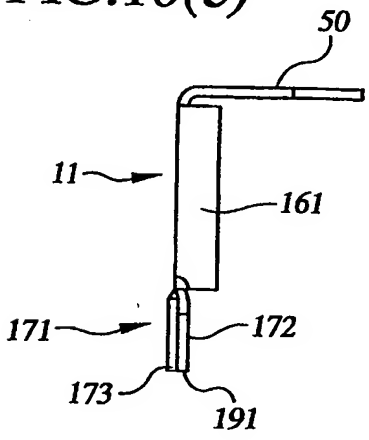

FIG.11(a)

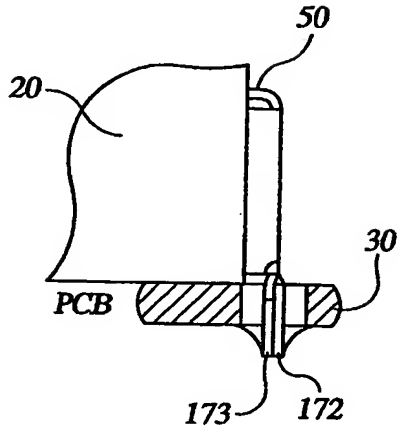

FIG.12(a)

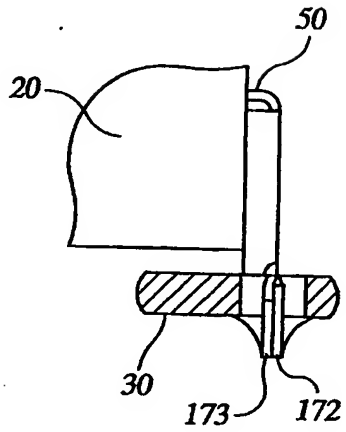

FIG.11(b)

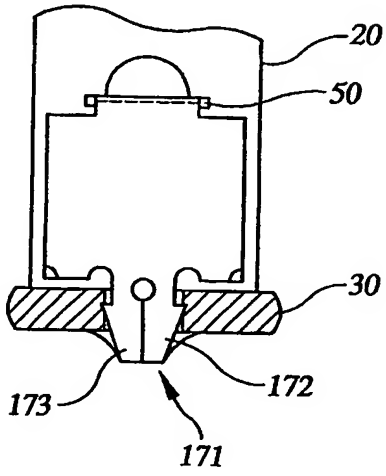

FIG.12(b)